

### Abstract

The nitride semiconductor layer structure comprises a buffer layer and a composite layer on the buffer layer. The buffer layer is a layer of a low-temperature-deposited nitride semiconductor material that includes AlN. The composite layer is a layer of a single-crystal nitride semiconductor material that includes AlN. The composite layer includes a first sub-layer adjacent the buffer layer and a second sub-layer over the first sub-layer. The single-crystal nitride semiconductor material of the composite layer has a first AlN molar fraction in the first sub-layer and has a second AlN molar fraction in the second sub-layer. The second AlN molar fraction is greater than the first AlN molar fraction. The nitride semiconductor laser comprises a portion of the above-described nitride semiconductor layer structure, and additionally comprises an optical waveguide layer over the composite layer and an active layer over the optical waveguide layer.

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